



THE ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D. C. 20301-1200

APR 16 2003

HEALTH AFFAIRS

The Honorable Duncan Hunter
Chairman, Committee on Armed Services
House of Representatives
Washington, DC 20515-6035

Dear Mr. Chairman:

The enclosed report responds to the request in House Armed Services Committee Report 107-194 (pages 336-7) for a comprehensive study of the Department of Defense (DoD) medical data systems that are designed to facilitate and/or track management, clinical treatment, systems performance evaluation, costs, manpower, and enrollment.

The language also requested that the study examine the capability of present and planned systems to meet stated goals and objectives, progress in implementing systems, shortcomings in existing systems, systems necessary to implement TRICARE For Life, and the ability of DoD to exchange clinical and management information with other federal and state agencies and private sector health services providers. As requested, DoD selected a federally funded research and development center, the Institute of Defense Analyses (IDA) to conduct the study.

We concur with the recommendations of the IDA and will take these into consideration when planning and developing our future information systems. IDA provided four recommendations to the Military Health System (MHS): 1) continue to build new systems with carefully designed requirements to replace less capable systems; 2) continue to evolve and implement the MHS architecture and Investment Portfolio to facilitate the implementation of new systems and eliminate shortcomings in the future; 3) work through the Health Information Interoperability Standards Council to improve data transfer with the Department of Veterans Affairs; and 4) participate in the development of plans for sharing data with other government agencies and private-sector providers.

IDA acknowledged that the evaluated systems are capable of meeting stated goals and objectives. The MHS has made progress in adopting best practices and applying them to processes used for defining, budgeting, prioritizing, and implementing new systems. The DoD medical data systems appear to be ahead of most government agencies with respect to data exchange.

Thank you for your continued support of the MHS.

Sincerely,

William Winkenwerder, Jr.
William Winkenwerder, Jr., MD

Enclosure:
As stated

cc:
Representative Ike Skelton



INSTITUTE FOR DEFENSE ANALYSES

Evaluation of DoD Medical Information Systems

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Executive Summary

The House Committee on Armed Services, in language accompanying the National Defense Authorization Act for FY 2002, directed the Secretary of Defense to undertake a comprehensive study of DoD's medical information systems that are designed to facilitate and/or track management, clinical treatment, system performance evaluation, costs, manpower, and enrollment. In August of 2002, the TRICARE Management Activity (TMA) signed a task order with the Institute for Defense Analyses (IDA) to conduct the study.

The Military Health System (MHS) capital investment portfolio development process provides the basis for prioritizing the functional requirements arising from mission needs, policy documents, and user requests and aligning them with information technology solutions and funding profiles. Each of the systems included in our evaluation was designed to meet the capabilities identified as an outcome of this process. To provide the context under which the selected systems were developed, our evaluation includes a review and assessment of the MHS investment portfolio development process and a brief discussion of the MHS Enterprise Architecture and its potential role in developing the investment portfolio.

There are more than 90 active legacy, interim, and migration systems that support the information management of the MHS. To reduce the scope of this evaluation to a manageable size, we asked the MHS to provide a list of their "major" systems (in terms of funding and extent of usage) that cover the functional areas called for in the congressional language. The systems selected were:

- Composite Health Care System (CHCS) I and II,
- Centralized Credentials Quality Assurance System (CCQAS),
- Defense Medical Human Resources System–internet (DMHRSi),
- Defense Medical Logistics Standard Support (DMLSS),
- MHS Mart (M2),
- Theater Medical Information Program (TMIP), and
- Third Party Outpatient Collection System (TPOCS).

We based our evaluation on documents provided by the MHS, recent evaluations performed by organizations such as the Gartner Group and the

General Accounting Office, discussions with MHS staff and, for the systems that have been deployed, interviews with a limited number of users made available to us by the MHS. Due to the short time period available for the evaluation, our conclusions are more tentative than the IDA team would have liked.

The remainder of the Executive Summary lays out each of the broad issues the congressional language required DoD to assess and broadly summarizes IDA's findings and recommendations on each issue. The main text provides more detailed findings and recommendations, particularly for specific information systems.

Issue #1: Capability of present and planned systems to meet stated goals and objectives.

Findings	Recommendations
A number of the MHS's active information systems are quite mature and were designed in a different information age environment. Many new, more modern systems, are in the process of design or implementation. The systems we evaluated are capable of meeting stated goals and objectives once they are deployed.	Continue to build new systems with carefully designed requirements to replace and absorb older, less capable systems.

Issue #2: Progress on implementing systems.

Findings	Recommendations
Over the past 2 or 3 years, the MHS has made much progress in adopting best practices and applying them to the processes it uses for defining, budgeting, prioritizing, architecting, and implementing new information systems to support DoD health programs.	Continue to refine the MHS Enterprise Architecture and Investment Portfolio to facilitate the implementation of new systems at all levels.

Issue #3: Shortcomings in existing systems.

Findings	Recommendations
A number of the extant MHS information systems have shortcomings in the context of today's technology. These failings occur in data integration, processes supported, and user interface transparency. (Note also the problem of information assurance, which we have not discussed in this report.) These problems are being addressed by the MHS as it defines its "to-be" portfolio.	Continue to evolve and implement the "to-be" architecture and Investment Portfolio to eliminate these shortcomings in the future.

Issue #4: Data systems necessary to implement the new TRICARE for Life Benefit.

Findings	Recommendations
No new DoD systems are required to implement the TRICARE for Life (TFL) benefit. The DEERS Civilian Health Care Benefit Code has been extended to indicate TFL eligibility. TFL claims data are recorded on Health Care Service Records (already used to record TRICARE network claims data) and sent to the MHS Data Repository.	None.

Issue #5: Ability of the DoD to exchange clinical and management information with other federal and state agencies and private sector health services providers in a timely and reliable manner.

Findings	Recommendations
The DoD and VA appear to be ahead of most government agencies with respect to data exchange. However, significant challenges remain.	The MHS should continue to work through the Health Information Interoperability Standards Council to improve data transfer with the VA. The MHS should also participate actively in the development of plans for sharing data with other federal and state agencies and private-sector providers.

I. Introduction

A. Background

The House Committee on Armed Services, in language accompanying the National Defense Authorization Act for FY 2002,¹ directed the Secretary of Defense to undertake a comprehensive study of DoD's medical information systems that are designed to facilitate and/or track management, clinical treatment, system performance evaluation, costs, manpower, and enrollment. In particular, the committee language requires the study to assess:

- capability of present and planned systems to meet stated goals and objectives,
- progress on implementing systems,
- shortcomings in existing systems,
- data systems necessary to implement the new TRICARE For Life benefit, and
- ability of the DoD to exchange clinical and management information with other federal and state agencies and private sector health services providers in a timely and reliable manner.

In August 2002, the TRICARE Management Activity (TMA) signed a task order with the Institute for Defense Analyses (IDA) to conduct the study.

The Military Health System (MHS) serves two major missions: a peacetime mission and a readiness mission. To address the peacetime mission, DoD operates 85 hospitals (not counting field and theater hospitals) and almost 500 clinics worldwide to care for eligible beneficiaries. These facilities provide about 75 percent of the medical care provided by DoD to its beneficiaries. In addition, beneficiaries may seek care from private medical practitioners through the TRICARE benefit, administered by Managed Care Support Contractors. The readiness mission is addressed by deployable medical units maintained by the military departments and by the personnel and facilities that treat beneficiaries in peacetime.

¹ House of Representatives Report 107-194, National Defense Authorization Act for FY 2002, *Report of the Committee on Armed Services House of Representatives on H.R. 2586*, 107th Congress, 1st Session, September 4, 2001.

TMA is a Field Activity of the Office of the Assistant Secretary of Defense (Health Affairs) (OASD(HA)). The TMA Director of Information Management, Technology, and Reengineering (IMT&R) serves as the Chief Information Officer (CIO) for the MHS and is the principal advisor to the Assistant Secretary of Defense (Health Affairs) (ASD(HA)) on matters related to information management and information technology. The IMT&R Directorate supports the MHS by implementing policies, procedures, programs, and technical standards necessary to acquire, manage, integrate, and secure information technology systems and capabilities that support the delivery of health care services in both peacetime and wartime.

Responsibility for the procurement, development, implementation, deployment, maintenance, and operation of these information systems is assigned to the MHS Information Technology (MHS/IT) office. The Program Executive Officer (PEO) heads the MHS/IT office and is designated the acquisition decision authority for these projects and programs. The PEO is responsible for support and oversight of all automated information system programs, while individual program managers take responsibility for individual programs. The MHS/IT PEO currently manages more than 90 active legacy, interim, and migration systems.

B. Study Plan

In discussions with MHS staff as the study plan was developed, it became apparent that no new data systems were required to implement the TRICARE for Life (TFL) benefit offered to Medicare-eligible beneficiaries. The only modification needed to existing systems was an extension to the DEERS Civilian Health Care Benefit Code to indicate TFL eligibility. Health Care Service Records (HCSRs), already used to record TRICARE network claims data, have been adapted to record TFL claims. The HCSRs record how the civilian provider's bill is apportioned among Medicare, DoD, and the beneficiary. Once adjudicated, HCSR data are sent to the MHS Data Repository.

To reduce the scope of this evaluation to a manageable size, we asked for a list of "major" MHS systems (in terms of funding and extent of usage) that cover the functional areas called for in the congressional language. The systems selected were:

- Composite Health Care System (CHCS) I and II,
- Centralized Credentials Quality Assurance System (CCQAS),
- Defense Medical Human Resources System–internet (DMHRSi),
- Defense Medical Logistics Standard Support (DMLSS),
- MHS Mart (M2),

- Theater Medical Information Program (TMIP), and
- Third Party Outpatient Collection System (TPOCS).

Table 1 maps the systems to be evaluated to the functional areas they support.

Table 1. Taxonomy of MHS Information Systems by Functional Area

System	Functional Area				
	Management	Clinical Treatment	MHS		
			Performance Evaluation	Costs	Manpower
CHCS I and II		X			
CCQAS					X
DMHRSi					X
DMLSS				X	
M2	X		X		
TMIP		X		X	
TPOCS				X	

We based our evaluation on briefings, meetings, interviews, and documents received from TMA (IMT&R) as well as on recent reports by the General Accounting Office, the DoD Director of Operational Test and Evaluation, and the Gartner Group. However, because we were operating under an extremely compressed time schedule, this evaluation is not as complete or comprehensive as we would have liked. We had only a limited amount of time to familiarize ourselves with the MHS requirements generation and portfolio development process, enterprise architecture, and information systems. Because of scheduling difficulties, interviews with users of the selected systems were all conducted over the phone in a single day. Because IDA has little direct experience with any of these systems (except for M2), we viewed the users as perhaps the most important source of information for this evaluation. Had time permitted, we would have preferred to schedule interviews with a larger and presumably more representative sample of users of the evaluated systems and to observe them using the systems in the performance of their everyday tasks.

The MHS capital investment portfolio development process provides the basis for prioritizing the functional requirements arising from mission needs, policy documents (such as the MHS Optimization Plan), and user requests and aligning them with information technology solutions and funding profiles. Each of the systems included in our evaluation was designed to meet the capabilities identified as an outcome of this process. To provide the context under which the

selected systems were developed, we begin our evaluation with a review and assessment of the MHS investment portfolio development process. We also touch briefly on the MHS Enterprise Architecture and its potential role in developing the investment portfolio. This is followed by the individual system evaluations and a discussion of inter-agency data exchange issues. We conclude the report with a summary of our findings and recommendations.

The MHS investment portfolio development process is a complex one, involving a number of agencies and a variety of systems. The MHS Enterprise Architecture (EA) is a key component of this process, providing a framework for the development and integration of systems. The EA is a high-level, strategic view of the MHS information systems environment, showing the relationships between different systems and the data they exchange. It is a critical tool for managing the MHS investment portfolio, as it provides a clear picture of the current state of the systems environment and the potential for future growth and change.

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II. Investment Portfolio Development and Enterprise Architecture

This section addresses the salient characteristics of the MHS investment portfolio development process, the MHS enterprise architecture, and the relationships between the two.

A. Investment Portfolio Development

The MHS has developed and documented a structured formal process for developing its investment portfolio and maintaining configuration management.² The Information Management (IM) Division of TMA is charged with managing the process and assembling the portfolio. The process consists of a number of distinct steps, organized into phases. The following is a brief description of the process.

1. Description

a. Identifying and Classifying Requirements

The IM Division identifies new information requirements that arise from policy documents and takes information about service requests from help desks, military medical departments, and users directly. The IM Division uses a commercial program called DOORS³ to organize and keep track of requests. It handles requests in a structured way, rejecting them if contrary to policy, forwarding them to the PEO for immediate action if they involve a fix that needs to be made immediately (e.g., if patient health and safety are involved), or accepting them for further consideration in developing the investment portfolio. The IM Division then informs the submitter of the disposition of the request. If the request is closely identified with an existing requirement, the two may be merged.

² See TRICARE Management Activity, "Information Management Requirements and Configuration Management Process," January 2002.

³ Dynamic Object-Oriented Requirements System (DOORS) is a product of Telelogic AB (www.telelogic.com).

b. Estimating Capabilities Costs

Information managers nominate capabilities for inclusion in the portfolio for the next programming cycle. The Director, IM then forwards the capability description packages to the PEO for life-cycle cost estimates.

The PEO organization identifies the capability description with a particular system or systems. To accomplish this, it assigns the capability to a primary Program Office and works out what changes to particular systems are required to obtain the capability. The PEO organization then estimates the costs of these system changes and provides a cost estimate for each package to the IM Division.

c. Ranking Individual Capabilities

Each of the six members of the Functional Integration Work Group (FIWG)—a group with representatives from the three military medical departments, joint staff, OASD(HA), and TMA—assesses each of the packages for value and risk, using the criteria and weights shown in Tables 2 and 3. TMA (IM) then assembles a tentative investment portfolio, ranked almost entirely by the aggregated scores of the FIWG members for each package. Table 4 provides an example of the outcome of this process.

d. Building the Investment Portfolio

The FIWG examines the slate of proposed capability packages, compares the slate with available funding, and forwards its recommendations to the military medical department CIOs. From there, the recommendations are forwarded to the Resource Management Steering Committee (made up of representatives of the military medical resource community) and the Information Management Proponent Committee (a flag-level committee) for inclusion in the OASD(HA) budget and program.

2. IDA Comments

The MHS has developed a comprehensive and structured approach to developing an investment portfolio that seems generally to comply with best practices. There are, however, three modest areas that the study team feels the MHS should examine within that process.

First, the MHS should re-examine the set of criteria and rankings used to evaluate individual packages (reproduced in Table 2) to ensure that the criteria produce the desired results. For example, it appears that a package that contributed no additional value and left customer satisfaction unchanged at the data-entry and end-user levels would garner a score of 8, higher than a package that produced savings sufficient to cover its costs in one year but slightly

Table 2. Requirements Scoring Criteria-Value

Criteria	Weight	Score					
		0	1	2	3	4	5
Value							
1. Strategic Alignment-Mission Effectiveness The extent to which a technology supports force health protection and the MHS optimization by one or more of the following: <ul style="list-style-type: none"> Increasing access to care, Improving provision of care, Facilitating population health care management, Promoting Manage the Business; and Enhancing Theater/Readiness capabilities. 	2	Makes no contribution to achieving a force health protection and MHS optimization strategic goal or negatively impacts on mission effectiveness.	Contributes indirectly to achieving at least one strategic goal of force health protection and MHS optimization.	Modestly contributes directly to at least one strategic goal of force health protection and MHS optimization.	Significantly contributes directly to at least one strategic goal of force health protection and MHS optimization.	Significantly contributes directly to (or is essential to) the achievement of one or more strategic goals of force health protection and MHS Optimization, positively impacts on mission effectiveness.	Significantly contributes directly to (or is essential to) the achievement of more than one strategic goal of force health protection and MHS Optimization, positively impacting on mission effectiveness.
2. Competitive Response The degree to which a failure to provide the technology or a delay in its implementation will cause negative impact on the organization.	1	Can be postponed for 12 months or more without negative effect.	Can be postponed for at least 12 months without negative effect, but organizational cost may increase.	Postponement for up to 12 months will incur mild competitive damage.	Postponement for up to 12 months will incur significant competitive damage with other private sector health delivery organizations.	Postponement will risk potentially permanent loss of important business.	Postponement could risk the survival of the organization.
3. Competitive Advantage The extent to which technology provides a unique advantage to supporting war fighters or otherwise makes the organization be perceived as an asset to the overall DoD.	1	Does not contribute to competitive advantage.	Does not contribute now, but may improve competitive advantage in the future.	Contributes indirectly to competitive advantage.	Modestly contributes directly to competitive advantage.	Substantially contributes directly to competitive advantage.	
4. Financial Cost versus benefits assessment, coupled with business process reengineering, which will allow the MHS to recapture the financial benefit.	1	Negative return on investment (ROI) over next 3 years or with little, if any, quantitative benefits for the MHS.	Uncalculated or not satisfactorily calculated ROI.	Provides 'break-even' ROI after 3 or more years.	Provides 'break-even' ROI after 2 years.	Provides 'break-even' ROI after 1 year.	Provides 'break-even' ROI within the first year.
5. Customer Perception The extent to which satisfaction is established at the data entry/interface level.	2	It does not improve or worsens satisfaction. Satisfaction is negative from previously established level.	Satisfaction level is unknown or cannot be determined.	Satisfaction level remains as previously established, is neutral or has no impact.	Satisfaction level increases slightly over previously established level.	Satisfaction level increases moderately over previously established level.	Satisfaction level increases significantly over previously established level.
6. Customer Perception The extent to which satisfaction is established at the end-user level, be it beneficiary, health care provider, health care executive, etc.	2	It does not improve or worsens satisfaction. Satisfaction is negative from previously established level.	Satisfaction level is unknown or cannot be determined.	Satisfaction level remains as previously established, is neutral or has no impact.	Satisfaction level increases slightly over previously established level.	Satisfaction level increases moderately over previously established level.	Satisfaction level increases significantly over previously established level.
Value Score	9						
Note: IT evaluation criteria are taken from the IT Capital Planning Course given at the Information Resource Management College of the National Defense University. (Marilyn M. Parker and Robert J. Benson, <i>Information Economics: Information Value in the Business Domain</i> , Englewood Cliff: Prentice Hall, 1988, pp. 25-47).							

Table 3. Requirements Scoring Criteria-Risk

Criteria	Weight	Score					
		5	3	-1	-1	-3	-5
Risk							
1. Organizational Risk The extent of exposure to concerning risks to the DoD organization and the degree to which such risks are managed. Positive risk management factors include effective management of change acceptance and being fully utilized within 12 months. Amount of investment required is within total life-cycle estimates to achieve full operating capabilities.	2	Helps to mitigate existing risks.	No increase in risks or exposure to risks.	Incurs mild risk that should not be difficult to manage.	Incurs increased risk in one or more areas that may be difficult to manage.	Incurs a major risk that is of concern to the organization.	Incurs a major risk that could seriously damage the performance or survival of the organization.
2. Cost and Schedule Risk The degree to which acquisition, development, and implementation can be accomplished within cost and schedule projections.	2	Very likely to be accomplished under projected cost and ahead of schedule.	Very likely to be accomplished within projected cost and on schedule.	Appears to be within cost and schedule projections.	Appears to be slightly over cost and schedule projections.	Likely to be moderately over cost and schedule projections.	Likely to be significantly over cost and schedule projections.
3. Technical Uncertainty The degree of technical risk as interoperability, standardization, training requirements need for operation, software dependencies, hardware dependencies, and complexity of interfaces or integration with existing applications.	1	There is no uncertainty regarding any technical factor or uses a pure commercial off-the-shelf (COTS) solution.	Requires no new hardware, software development or training requirements to implement with operational setting, or will use a COTS solution with minor modifications or interfaces.	Requires some hardware upgrades, but no software or training to implement in operational setting.	Requires new hardware and some software changes to existing applications, but no training to implement in operational setting.	Requires new hardware and some new software development and integration along with new training standards.	Requires substantial new hardware, new software development, and major integration effort along with total new training program.
4. Infrastructure Risk The degree of impact on existing IT infrastructure or need to procure additional infrastructure to support initiative.	1	No investment required; no burden added.	Some minor infrastructure changes will be required; minimal investment is involved.	Some changes in several areas will be required; modest investment is involved.	Moderate changes will be required and will use a significant part of the infrastructure support capacity.	Changes affecting many areas will be required; significant investment will be required or could seriously burden the existing organization infrastructure and degrade the performance of other functions.	Substantial infrastructure investment will be required or will seriously burden present infrastructure and performance.
5. Definitional Uncertainty The degree of uncertainty placed in the confidence of the requirements or the concept of employment of the technology in MHS settings.	2	Requirements and processes are firm, with high degree of certainty; complexity is not a problem; very predictable.	Requirements and processes are moderately firm; some complexity; relatively good predictability.	Requirements and processes are likely to change as needs are better understood; some complexity.	Requirements will need to change because they relate to a dynamic or complex area or environment.	Requirements are only partially known and they relate to a dynamic or complex area or environment.	Requirements are substantially unknown or are unclear; may involve much complexity or constant change.
Risk Score	8						

Table 4. Sample Functional Requirement Rankings

FY03 Funding	Area	Ref #	FY03-07 Capability	FY03 Rank	Score: Low Value to High Value [0, 1, 2, 3, 4, 5]						Score: Low Risk to High Risk [5, 3, 1, -1, -3, -5]					Total Points	Weighted Total Points											
					Value						Risk																	
					Strategic Alignment - Mission Effectiveness	Competitive Response	Competitive Advantage	Financial	Customer Perception I	Customer Perception II	Organizational Risk	Cost & Schedule Risk	Technical Uncertainty	Infrastructure Risk	Definitional Uncertainty													
																		Weights						Weights				
																		2	1	1	1	2	2	2	2	1	1	2
				48	20	14	17	9	13	15	4	-8	-12	-6	-8	58	94											
				2	23	19	19	8	17	23	27	9	-2	4	10	157	266											
				30	20	16	13	8	14	21	10	4	-2	2	8	114	191											
	MTB	FY03-81	Patient Accounting	1	23	18	22	15	18	23	26	6	8	2	6	167	269											
	MTB	FY03-17	Equipment Management / Stock Room Readiness	3	24	16	19	16	17	20	22	6	4	-2	8	150	247											
	PC/PH	FY03-43	Clinical Documentation – Theater Band	4	26	12	17	6	25	25	16	6	-2	2	6	139	243											
	Theater	FY03-38	Theater Integration	5	27	21	19	7	16	21	22	4	-4	4	8	145	243											
	ATC	FY03-225	E-Health	6	25	16	21	10	17	26	13	8	0	2	7	145	241											
	MTB	FY03-60	Joint Medical Asset Repository (JMAR)	7	26	17	19	9	15	22	18	6	2	5	8	147	242											
	PC/PH	FY03-47	Orders Management – Theater Band	8	24	13	16	11	22	23	22	8	-8	-2	6	135	240											
	PC/PH	FY03-59	Disease Management – Theater Band	9	20	11	15	8	15	21	26	4	8	6	10	144	240											
	PC/PH	FY03-40	Global Clinical Data Repository – Theater Band	10	25	13	18	7	20	23	22	8	-4	-4	6	134	238											
	PC/PH	FY03-107	HEAR	11	25	15	20	13	17	23	16	4	2	0	8	143	236											
	ATC	FY03-67	Enterprise Wide Registry	12	22	16	20	8	15	21	24	3	-3	-1	6	131	222											
	PC/PH	FY03-229	Replace Ancillary Systems: Pharmacy, Clinical and Anatomic Pathology Laboratory, Radiology	13	23	19	20	7	18	23	22	6	-10	-6	4	126	222											
	MTB	FY03-302	Very Small Site Deploy	14	19	12	15	11	14	18	22	6	2	4	6	129	214											
	ATC	FY03-87	Enterprise Wide Provider Database/Credentials	15	21	12	15	6	15	18	24	4	0	2	6	123	211											
	PC/PH	FY03-205	Integrate Dental Info Into Single Location for Storage & Retrieval-Imaging	16	18	11	15	8	17	21	22	6	-6	-6	10	116	210											
	PC/PH	FY03-51	Integrate Medical Surveillance – Theater Band	17	24	12	14	7	18	22	12	8	-4	0	6	119	209											
	MTB	FY03-55	Medical Surveillance	18	19	12	15	8	15	21	20	4	0	2	6	122	207											
	MTB	FY03-188	Enterprise Wide Human Resource Planning	19	20	16	18	6	19	22	24	0	-4	0	0	121	206											
	Theater	FY03-213	TRAC2ES Auto Sec Guard	20	20	15	15	9	14	16	22	4	-4	6	6	123	205											
	MTB	FY03-216	MHS Electronic Commerce	21	20	14	13	9	12	17	18	10	0	2	6	121	204											
	MTB	FY03-307	Interface with EAS to Capture Amb CPT Data	22	17	15	16	6	10	18	22	4	0	8	8	124	203											
	MTB	FY03-210	Air Evac Equip Mgmt	23	24	14	16	6	12	19	16	4	0	7	4	122	201											
	MTB	FY03-215	Data Migration from USAMISSA to DISA	24	17	13	15	9	10	16	24	4	6	4	6	124	201											
	PC/PH	FY03-226	CIS-CHCS Bi-Directional Interface	25	19	11	15	7	14	20	20	6	-2	4	4	118	201											

decreased customer satisfaction (5 points for breaking even in a year, 0 for decreasing satisfaction). While such perverse results may be unlikely, they seem worth guarding against. Giving credit for value when user satisfaction cannot be determined in advance seems particularly risky.

Second, the projects in the tentative portfolio the IM Division presents to the FIWG are ranked in the order of their value and risk evaluation scores by the individual members of the FIWG. Although the FIWG is provided with cost data, these data do not play an explicit role in the rankings of the projects. This means that a project with a high evaluation score but a high cost would be ranked ahead of projects that had lower evaluation scores but lower costs. It is possible that the total evaluation score of the lower-cost packages would be higher (for the same money) than the more expensive project.

Since the IM Division presents the FIWG with cost data as well as the rankings, the FIWG can take this into account as it builds its final recommendations. It might be better, however, for the IM Division to take the cost of each project into account in building the tentative slate—ranking projects in terms of their evaluation score per dollar of expense rather than their absolute evaluation scores.

Third, since cost estimation is a function performed solely by the PEO, there is little feedback between the IM Division and the PEO as cost estimates are prepared (although there are mechanisms in place to help ensure that the PEO fully understands the nature of the capabilities for which it is being asked to provide cost estimates). The Director, IM typically questions the cost estimate prepared by the PEO (and therefore the underlying technical solution) only if the estimate appears inordinately high. In these cases, the primary cost drivers of the proposed technical solution are identified and discussed, sometimes resulting in a scaled down requirements set. More routine discussions about what accounts for the bulk of the cost of each proposed capability, however, might result in redefinitions of requirements, allowing them to be executed more effectively or at lower cost. Such a process is part of the business process reengineering now encouraged as an important component in DoD acquisition reform. As part of its reengineering process improvement during the construction of the FY 2004 portfolio, the IM Division pursued this approach with the PEO to a greater extent than was done in previous years.

B. Enterprise Architecture

Responding to legislative and DoD directives and guidance, the ASD(HA) has established the requirement for an MHS enterprise architecture. The drivers for such an architecture include, among others, the Clinger-Cohen Act of 1996,

requirements of the DoD Global Information Grid, and the format of the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Architecture Framework. TMA (IMT&R) coordinates the development of the MHS Enterprise Architecture (EA).

1. Description

The MHS Enterprise Architecture employs the DoD C4ISR Architecture Framework, which provides uniform methods for describing information systems and their performance in context with mission and functional effectiveness. The Framework consists of a series of interrelated architecture products for each of three views: Operational View (OV), Systems View (SV), and Technical View (TV) of the architecture. The MHS EA provides both "as is" and "to be" states of the Operational View. It also provides an All View, which serves as a high-level global and enterprise picture of the aggregate MHS architecture and serves as a central source for all definitions used in the MHS EA.

The goal of the MHS EA architecture and its supporting configuration management process is to set the stage for the integration of cross-functional, cross-system, and cross-agency information requirements, which ultimately supports centralized direction with decentralized execution. The MHS target end-state is a network information-centric, web-based environment allowing appropriate DoD users to access shared data and applications, regardless of location. In its present state, the MHS's Operational Views describe the concept and strategy as a "to be" operational architecture for the 2007-2010 timeframe.

a. C4ISR Architecture Framework

The three views of the C4ISR Architecture Framework provide the following information:

- The OV products are a description of the tasks and activities, operational elements, and information flows required to accomplish or support the functional operation.
- The SV products are a description, including graphics, of systems and interconnections providing for, or supporting, the operational functions.
- The TV products are the technology standards required to ensure that a conformant system satisfies the specified set of requirements, includes a forecast of the general availability of future versions of technology standards, and is available at both the overview and detailed levels.

b. Development Process

Development and enhancement of the MHS EA is a joint collaborative effort. The TMA Electronic Business, Policy, and Standards (EBPS) Division leads the development of the Operational View; the PEO is responsible for the Systems View; and the TMA Technology Management, Integration, and Standards Division is responsible for the Technical View. The MHS CIO designated the EBPS Director as Chief Enterprise Architect for the MHS Information Management/Information Technology (IM/IT) Program.

The MHS EA products are developed, maintained, and validated by three component offices that report to the MHS CIO. The actual validation process is unique to each architectural product. The overall common goal of each of these validation processes is to ensure that the product is usable for its intended purpose and is consistent with current MHS, TMA, OASD(HA), DoD, and federal policy and guidance.

The current version of the MHS EA (Version 2.0) consists of products from each of the three views. Some of the products are "essential" and therefore considered an integral part of any EA. Others are "supporting" and provide amplifying artifacts. The MHS OV products describe the MHS business processes and were developed using the MHS Optimization Plan, the Enterprise Information Architecture Guidelines, and the MHS Functional Area Model-Activity. The OV products support both the "as is" and "to be" states projected to 2010. Scenarios are developed to accompany each of the four core processes of the Future State Business Process Model in support of the vision of the 2010 MHS Activity Model. The SV products depict a baseline of the 2000-2001 functional information requirements, which currently support MHS operations and are planned to support the Fiscal Year Program Objectives Memorandum (FY POM) for the foreseeable future.

MHS EA products deemed to be of high importance have been validated by functional subject matter experts (i.e., functional and systems personnel from DoD and Service medical departments, Program Offices systems managers, the Technical Integration Working Group, the Functional Integration Working Group, and the Information Technology Architecture Integrated Product Team). Other products are still under development and will be validated at a future date.

c. Accomplishments

The functional and systems program managers, architects, and designers involved in supporting the business processes of the MHS with information technology are the primary users of the MHS EA. The MHS also uses it as a decision support tool for senior management. It provides a framework for

business decisions involving systems integration, migration, information assurance, and new development.

Specifically, a well-defined EA helps the MHS:

- Support its capital planning and investment control processes;
- Develop and enhance future MHS programs;
- Improve, re-engineer, and integrate MHS best practices to implement solutions in response to emerging business needs;
- Align IM/IT support with business objectives and foster interoperability among MHS, DoD, other federal agencies and business partner systems;
- Identify opportunities for increased interoperability and information sharing;
- Identify opportunities for taking advantage of new technologies and standards; and
- Support analysis of alternatives, risks, and trade-offs.

One important derivative arising from the development of the MHS EA is construction of an explicit list of data from about 1,800 Information Exchange Requirements (IERs) between operational nodes. Of the latter, however, only about 14 IERs cover about 80 percent of the total information exchanges.

Current efforts include regularly updating MHS EA products and expanding the scope of the MHS EA to reflect the IM/IT Strategic Plan. The MHS currently maps all new capabilities being considered for funding during the IM/IT portfolio investment process to their appropriate operational views and critical data elements. This mapping will result in more consistent technical solutions and interoperability, thereby improving the performance of the TRICARE health program.

2. IDA Comments

It is clear to the study team that the MHS has taken seriously its need to develop an enterprise architecture and is in compliance with the C4ISR Architecture Framework. This process is still evolving, and more detail needs to be entered for systems that are documented. Specifically, newer systems have been documented, while older legacy systems remain to be documented as they are migrated or updated. As it stands now, the strength of the MHS EA lies in its emphasis on Operational View descriptions, describing clearly and concisely the military health community's business practices. The MHS IM/IT community has embraced the DoD's general guidance on following best commercial practices, adopting commercial products and conforming to commercial standards where they serve the DoD's needs.

More work is still required for the Systems Views. The IER exchange material covers more than 1,800 exchanges between operational nodes. This level of detail is fine for operational inter-nodal considerations, but it does not appear to provide the visibility needed on system-to-system intra-nodal exchanges. Operational nodes typically use several systems and it is not immediately clear which systems provide and which receive the indicated information. The optional C4ISR intra-nodal views would help this situation. More detail is needed on how the information is transferred, such as adding supporting SV-10 views. The logical data model material should be augmented and enhanced in the web form made available to the IDA team. There does appear to be a respectable entity-relationship model behind the material provided to us, probably in ERWin (a data modeling product for creating and maintaining databases, data warehouses, and enterprise data models), but the entity and attribute reports generated for the web site are not the best way to view this information.

C. Findings and Recommendations

MHS efforts to date have resulted in products that can be used to advantage in evolving the portfolio of information technology to better serve the MHS community. However, many of the program managers and participants in the portfolio development process may not yet be taking full advantage of the information encompassed in the MHS EA. We strongly recommend that this capability be folded into the overall technical and budgeting processes. We are encouraged because, in the MHS IM/IT Fiscal Year 2003 Annual Performance Plan, both the PEO and the EBPS offices have high-priority program activities aimed at making more effective use of information by mapping new capabilities to the common computing platform documented in the "to-be" system architecture. This directly addresses one of the study team's major concerns.

Without fully using the information encompassed in the MHS EA, portfolio decisions are likely to be less globally optimized than they otherwise could be. We encourage the MHS to continue developing and evolving the MHS EA and to develop mechanisms to use it to best advantage in investment portfolio decisions, such as a direct feedback loop into the requirements process at a relatively early stage. These actions should include mapping all capabilities packages to the Operational Architecture, and identifying all supporting business activities and information exchange requirements. The information that flows from such a procedure should increase the accuracy of cost estimates that the IM Division and PEO include in the final set of capabilities packages they forward to the FIWG.

III. Evaluation of Individual Systems

A. Composite Health Care System (CHCS) I and II

CHCS I is the major automated information system for DoD's fixed medical facilities (clinics and hospitals). CHCS II, currently under development, will expand and modify hospital automated information system capabilities, and will eventually replace CHCS I in its entirety, doing so in a number of stages.

1. Description

The original CHCS, now CHCS I, first introduced in 1988, is a tri-Service medical management system now used in all DoD military Medical Treatment Facilities (MTFs) to support hospital administration and clinical health care. It has provided computerized order entry for 14 years, a capability only now becoming common in the private sector. The existing CHCS I system consists of a group of modules that make appointments and record patient data, clinical notes, and laboratory and radiology results. Data are stored on 102 regional (local) host facilities that support one or more facilities. Data for different facilities may be segregated (i.e., data for a single patient is not grouped into a single record if the patient has been seen at more than one of the supported facilities). Hosts do not share data among them or across partitions on the same host. The current CHCS I version is Release 4.6. The system offers relatively rudimentary capabilities enabling a physician to write up encounter notes, which have not proved popular with providers. Typically, however, notes are maintained in hard-copy files.

The principal functional improvements offered by CHCS II Block 1, the initial deployable version, are greater support for ambulatory clinical encounters and creation of a single computerized patient record (CPR) for each patient. That record is to be available for use and modification by medical personnel for each patient encounter, regardless of the DoD facility at which care has been or is received.⁴ The CPR for all participants is stored and maintained in a Central Data Repository (CDR) at a Defense Information Systems Agency (DISA) facility in Montgomery, Alabama.

⁴ At present, TMA plans to transfer only about 2 years of data from the existing CHCS I computer systems, but all future patient encounters will be captured by CHCS II.

At each MTF, CHCS II Block 1 will add hardware and software that will provide user functionality and extract data from the legacy CHCS I. The CHCS I system also provides order fulfillment and connection to the external Defense Enrollment Eligibility Reporting System (DEERS). Also provided is a security server subsystem, which provides user access services at the MTF via role-based security, connection to TPOCS and an End-User Device (EUD) subsystem that consists of the workstations through which the clinical user gains access to CHCS II. Connection to the CDR is by way of a DISA-provided wide-area network. An MTF may also host one or more adjoining or satellite MTFs at which only EUD subsystems are provided, thereby reducing hardware and software requirements and sustainment costs.

The system will connect to other systems as well, including the Pharmacy Data Transaction Service (PDTS), a bi-directional data transmission service that electronically transmits encrypted prescription data between MTFs and a central pharmacy data depository to reduce the likelihood of drug interactions, therapeutic drug overlaps, and duplicate treatments. PDTS covers all MHS pharmacies including MTFs, network, and mail order. Processing approximately 350,000 transactions a day, PDTS identified over 42,000 potential level 1 drug interactions between 1 December 2000 and 30 June 2002 and called them to the attention of the prescriber or the pharmacist filling the prescription.

CHCS II contains features that the MHS expects will lead to improvements in medical care. The software offers superior patient notes capabilities, with greater data standardization coming from the use of "pick lists" and common definitions. The software will offer clinical guidelines—suggested treatments given the signs and symptoms presented by the patient, using a 3M commercial off-the-shelf (COTS) clinical data repository.

The MHS anticipates that by providing a greater degree of automated assistance to physicians it will have a source of easily extractable data that will greatly reduce the cost and effort needed for better medical surveillance, for epidemiological studies, for quality of care assessments, and for evaluation and management of physician activity. CHCS II is estimated to have a total life-cycle cost of about \$4 billion from Milestone 0 in January 1997 through 10 years following Full Operational Capability.

2. Capabilities

CHCS II Block 1, which has successfully completed Operational Test and Evaluation (OT&E) and has been approved for limited deployment, builds on the capabilities of existing systems (subsuming their functionality over time), addresses shortfalls, and adds new functions.

Initial CHCS II capabilities include:

- Assessments of medical deployability of service members;
- Pre-deployment medical exams to record existing medical conditions;
- Post-deployment medical exams to note changes in pre-existing conditions and to identify new conditions whose onset occurred during deployment;
- Records maintenance in a central location;
- Comprehensive, life-long medical record of illness and injuries, care received, immunization status, and environmental exposures;
- Provision of real-time objective data on individual medical readiness;
- Disease management;
- Demand prediction based on need; and
- Proactive management of the demand for health services.

CHCS II Block 1 interfaces with DEERS (managed by the Defense Manpower Data Center) and with the following existing MHS systems:

- Executive Information/Decision Support (EI/DS),
- TPOCS, and
- CHCS I.

CHCS I will continue to provide all appointments, laboratory, radiology, and pharmacy orders, but those functions will be accessed through CHCS II in a way that is invisible to the user. The results of all CHCS II submissions are forwarded to the CDR for storage in the patient's CPR. Authorized users can then view the CPR data on any CHCS II EUD.

Subsequent CHCS II releases will have additional interfaces to other systems such as:

- CHCS II Theater and
- U.S. Transportation Command Regulating and Command and Control Evacuation System (TRAC²ES).

CHCS I modules will be phased out as CHCS II capabilities replace them. However, CHCS I will not be turned off until all of its capabilities have been replaced, as it is a unitary system.

3. Evaluation

Our evaluation relied principally on two recent studies, one by the General Accounting Office (GAO)⁵ and the other by the Gartner Group,⁶ as well as interviews with a small number of CHCS II users.

a. GAO Study

The GAO report notes that DoD did not meet its commitments to deliver the first CHCS II system capabilities in May 1998 and associated benefits in April 1999. It attributed these failures to the initial use of a web-based architecture that did not meet system performance requirements, initial requirements that were ill-defined, a later influx of requirements changes, and budget cuts that forced changes in the project's scope and approach.

Having said that, the report notes the MHS's recent progress in adopting best practices in the management of the program. It identified four principal areas of concern. The first concern involves the costs and benefits of the program. The GAO expressed concern that the benefit calculations that had been done in 1998 addressed the benefits from the program as a whole and did not reflect the benefits that might be obtained from any block or blocks of functionality. It also expressed concern that Release 1 acquisition costs through April 2002 had run to \$284 million, more than twice the amount approved in 1998 to acquire Release 1 and deploy it to a single region, in part because of increases in the capability of the system.

The second concern involves a technical issue. The GAO was generally pleased with the results obtained during acceptance testing and operational testing. However, the report expressed concern that, while category 1 and category 2 defects (those affecting patient health and safety or significantly affecting mission-essential capabilities) had been fixed by the end of June 2002, some 46 category 3 defects (those requiring significant work-arounds) still remained. The report notes that the test plan calls for only category 1 and 2 defects to be fixed before deployment. However, the MHS plans to correct all defects identified prior to July 31, 2002, except for 11 that are embedded in vendor COTS products, before deploying Release 1.

The third area of concern involves the management of risks. Although the GAO noted that the MHS had "largely implemented a process for managing CHCS II risks that meets risk management best practices," the GAO expressed

⁵ U.S. Government Accounting Office, "Information Technology: Greater Use of Best Practices Can Reduce Risks in Acquiring Defense Health Care System," GAO-02-345, September 2002.

⁶ The Gartner Group, "Independent Review of CHCS II Technical Architecture," Summary Briefing, September 2002.

some concern about the quality and currency of the risk database and recommended that senior management be briefed every 6 months on the schedule, cost, and performance risks of the system.

Finally, the GAO expressed concern that performance-based contracting was not yet in use in the CHCS II contracts but noted that the program office plans to use performance-based contracts for CHCS II Release 3 and beyond.

In summary, the GAO's conclusions were:

Owing largely to the absence of the kind of management and technical controls that are hallmark qualities of system investment and acquisition best practices, CHCS II's early years produced little more than lessons learned. Since then, the project's management team has recognized the need to change and given priority attention to doing so. As a result, they introduced key missing best practices and made other improvements to the project, some of which have occurred during the course of our review. These needed practices and improvements have contributed to where MHS stands today: in the later stages of having an initial version of CHCS II that shows signs of maturation and operational readiness, although questions about operational efficiency due to unresolved defects remain a concern.

A larger concern, however, are unanswered questions about CHCS II's investment value. These questions exist because the project's management and oversight teams, to include both the MHS and DoD CIOs, have not given implementation of incremental investment management practices adequate priority and attention. Greater use of best practices in the areas of investment, risk and contract management will better position CHCS II management to ensure that it will not only be investing in the right vehicle but that it will be investing in the right way, meaning that it will be following the kind of proven management practices that increase the probability that required system capabilities and expected benefits will be delivered on time and within budget.

b. Gartner Group Study

The MHS commissioned the Gartner Group to examine the technical architecture of CHCS II and report on what portions of it could be made web-compatible. In making its evaluation, the Gartner Group compared CHCS II to other medical information systems and relied on expert opinion. It observed that, while CHCS II is a challenging system in that it is expected to support 4,200 active concurrent users and handle peak transaction rates of 362 per second, these challenges are comparable to those being met by leading-edge commercial systems today. However, worldwide deployment, the deployment of nearly the same product to theater, and the use of installation- and DISA-managed networks are beyond those seen in civilian centralized patient record systems.

In its evaluation, the Gartner Group observed that CHCS II integrates multiple COTS products with CHCS I. The architecture is based on industrial strength building blocks, particularly the database and transactions managers. The study identified five risks:

- Performance/scalability: functional or user behavior changes stretch the system to the point where response times are affected;
- Availability: central site failures, networking failures atypical of experience so far, and PC management issues would hamper availability;
- Technology: long-term changes in technology affect the ability to scale to meet new requirements or interface with future COTS or developed systems;
- Benchmarking: current benchmarks, although done well, have not modeled full load; and
- Survivability upgrade: prompt recognition and rollover to cached database are needed; determination of how to rollover and rollback not complete.

The study noted that mitigations were in place for most of those risks, and found no architectural reason not to deploy the system. It found that the technical architecture was state of the market. The Gartner study's principal recommendations were to:

- Evaluate scaling against inpatient functionality,
- Re-benchmark on full-size configuration,
- Determine rollover/rollback strategy for the survivability upgrade,
- Authorize web-enabled provider access for limited functionality, when security implementations are appropriate, and
- Continue to evaluate thick-client technologies during the evolutionary development of CHCS II.

c. User Interviews

Because CHCS II has just completed test and evaluation in a limited number of clinics at four MTFs, users of the system are few in number. The IDA team was able to talk to just two, both of whom were physicians assigned to TMA. One had had experience in actually using CHCS II while conducting patient examinations, the other had sat beside users while they conducted examinations. Both were enthusiastic about the system, and saw significant advantage in having the patient's record available on the system while they were conducting an exam. Neither user reported any difficulty with system performance. One

user reported that he thought proficiency in use could be obtained in 2 to 4 hours. Help desk support and system response were both rated as very good or better.

Although both users saw CHCS II's patient record facility as improving the documentation of care given during patient encounters, improving the thoroughness of notes prepared (and therefore, perhaps, the quality of care in future encounters), neither was willing to state that they would be able to see more patients. However, the Clinical Information Technology Program Office claims that CHCS II's benefits are not based on increased provider productivity. They claim that CHCS II's automated documentation features keep providers from staying after hours to review their shorthand notes and record them in patients' records, but that providers spend about the same amount of time with their patients.

4. Findings and Recommendations

Based on the Gartner Group and GAO reports, as well as the user evaluations, it appears that the technical risks associated with CHCS II Block 1 have been largely overcome. The question of benefit risks remains open. While the Naval Center for Cost Analysis conducted a favorable independent cost analysis of CHCS II, that review did not address the benefits of the program.⁷

In particular, the IDA team was concerned about whether some non-system issues might limit the value to be gained from the CPR. When a patient is seen for the first time at a facility that has CHCS II, his/her existing clinical data on the local CHCS I server are loaded into his/her CPR. These data contain lab tests, prescriptions, and radiation tests performed locally. In some cases, they may include provider notes. In general, the CPR will contain relatively little data from before the time it was created, but all data on treatment at DoD facilities from that date forward. There is no plan to capture the data that exist in the hard-copy patient record. With time, the severity of this limitation on the usefulness of the computerized record will decline as an increasingly longer treatment history is contained in the computerized record.

CHCS II is limited to DoD treatment facilities. DoD beneficiaries (with the exception of active-duty personnel) receive substantial portions of their care from network providers. Failure to include the notes and other information generated in encounters with network providers in the electronic record means that DoD providers will still have to refer to the hard-copy record (or the patient) for

⁷ D. Ziemba, Director, Naval Center for Cost Analysis, Memorandum for the Office of Secretary of Defense, Program Analysis and Evaluation, 15 October 2002, Subject: Composite Health Care System II (CHCS II) Component Cost Analysis.

information about these encounters. This situation, which will not improve with time, significantly limits the usefulness of the computerized record for patients who receive a significant portion of their care outside of military facilities.

The IDA study team recommends that the MHS evaluate whether it would be worthwhile to electronically capture existing data in its own and other providers' hard-copy files, with an eye toward improving the completeness and, hence, the value of the CPR.

B. Defense Medical Logistics Standard Support (DMLSS)

1. Description

As its name indicates, DMLSS is the MHS's medical logistics information system. It provides materiel and financial management functional capabilities to medical logisticians, thus enabling the reporting of finance and accounting, asset visibility, and command and control data and information. It is a Tri-Service suite of applications that standardizes medical logistics at the retail level among the Services, reduces the time providers and health care professionals spend on logistics activities, and improves the effectiveness and efficiency of health care delivery. DMLSS has achieved significant savings by implementing Just-in-Time practices, eliminating the need to maintain large inventories of pharmaceutical and medical/surgical items at the wholesale level and at military treatment facilities.

DMLSS relies on electronic commerce to speed delivery of pharmaceutical and medical/surgical items to customers, negating the need to stock large inventory at depots and military treatment facilities. It provides automated product and price comparison tools that ease the ordering process and encourage customers to purchase the most cost-effective products. DMLSS provides an assembly management capability that ensures that deployed forces are provided the right mix of equipment and materiel consistent with the current practice of medicine in fixed military treatment facilities and the commercial healthcare sector. In support of readiness, the DMLSS Program relies on commercial and military asset visibility. Using knowledge of the pharmaceutical and medical/surgical asset posture in the commercial sector, DMLSS supports deployed forces using the right mix of modern materials and equipment known to be available in the commercial sector in sufficient quantities to meet requirements.

2. Capabilities

DMLSS, currently in its third release, has reached considerable maturity. Release 1 of DMLSS was primarily an automated catalogue system that provided a stand-alone interface to prime vendors, limited facility management capabilities, and forward customer support.

Release 2, which completed deployment to 109 sites in December of 2001, was a distinct improvement over its predecessor. It provided modules for most important logistics functions, including:

- Facility management,
- Customer support (web-enabled),
- System services,
- Integrated prime vendor interface, and
- Customer area inventory management.

With Release 2, logisticians had the tools necessary to manage inventories and automate reordering functions.

Release 3, first deployed to eight test sites in March 2001, is now deployed to 25 DoD hospitals and is scheduled to be fully deployed in the next 18 months. It replaces all legacy logistics systems, provides improved modules for the Release 2 functions (listed above), and new modules for the following logistics functions:

- Stockroom readiness inventory management,
- Assemblage management,
- Equipment management, and
- Equipment maintenance.

The DMLSS architecture is a dedicated local client/server arrangement, using a combination of COTS products and developed software. The clients access a dedicated server via a local-area network. Some remote locations may reach the server via the Internet. The local server is connected to the Defense Logistics Agency (DLA) over the NIPRNET. DLA maintains the electronic catalogue and other wholesale functions (e.g., connections to prime vendors) via the Defense Information System Network. DMLSS has become the medical component of DLA's family of logistics systems.

Near-term programmed improvements include the integration of patient movement items into DMLSS and the development and fielding of the Joint Medical Asset Repository. The first of these would complement TRAC²ES, the legacy patient movement system. The second would provide medical planners with the ability to see exactly what medical assets (including blood) were

available in DoD and where they were. This capability is intended to enhance readiness by providing DoD-wide visibility of amounts and locations of critical supplies and equipment.

Remaining issues involve the proliferation of the system to very small sites, upgrades to the electronic commerce and pharmacy modules, point of consumption management, regional logistics management, and interfaces to other systems such as the Expense Assignment System IV (for automatic cost reporting).

3. Evaluation

The IDA team was able to speak with two users of DMLSS, both of whom were assigned to medical logistics functions at MTFs (one Navy, one Air Force). Both users had adopted DMLSS early on, had trained their respective military medical departments, and were running Release 3. Both expressed great satisfaction with DMLSS and stated that Release 3 was a great improvement over Release 2. One of them stated that the greatest fear his people had was that they would be reassigned to a base that did not yet have Release 3 of DMLSS.

Movement from DMLSS Release 2 to Release 3 was reported to be easy to accomplish without disruption in operations; training for the new release was considered adequate.

Both users reported that the help desk and system support received were excellent. One reported that of 230 tickets called in, all had been responded to and 70 to 80 had been incorporated in subsequent upgrades. Releases and upgrades were frequent, some 20 in number since June 2002.

The users reported that they were able to clear out their warehouses due to the rapid and reliable ordering capabilities offered by DMLSS.

Both sites had replaced legacy systems as Release 3 came online. One user was able to work out facility management interface issues locally (the base uses different software, and a means for DMLSS to communicate with it needed to be worked out), but the other had not, meaning that some parts of the facilities management process were still being handled by faxing hard-copy forms.

The users reported productivity increases as a result of DMLSS Release 3 mostly in terms of reduction of hard-copy form production and elimination of the legacy systems.

Both expressed a desire for more support on contract management and on joint contracting with the Department of Veterans Affairs (VA). The users also expressed a desire for future improvements in budget management and facilities management, both of which appear to be interface issues with resource management and facilities management personnel.

The performance of the system was rated as excellent—it has proven to be highly reliable. The only system failures reported had been external (caused by a heat-induced server shutdown). The system did not appear to degrade as the number of users changed.

4. Findings and Recommendations

DMLSS appears to be a great success in the field. Users like the system, and adoption of the system has resulted in great reductions in the number of items stocked in DoD warehouses. Four-fifths of all orders are filled within 24 hours, and the remainder within the following 2 days. Test and evaluation of Release 3 seems to have gone smoothly; the last issues to be resolved involve its ability to interface smoothly with Army financial systems.

The system has won a number of awards, including the DoD Electronic Commerce Pioneer Award in 1999 and 2001; the E-Gov Explorer Award in 2001; the Post Newsweek Government Computer News Agency Excellence Award in 2001; and the Federal Computer News Agency Excellence Award in 2001.

More importantly, DMLSS has permitted a reduction in the number of pharmaceutical and medical/surgical items stocked by DLA, the number of items received by the ordering entity within 24 hours, and the number of items received within 72 hours of ordering. Between 1992 and 2000, the number of medical items stocked by DLA fell from 13,853 to 2,804, an 80 percent decrease, while the value of stocked items at DoD facilities fell from \$167 million to \$32 million, an 81 percent decrease. At last report, 80 percent of items ordered were received by the ordering entity within 24 hours, and nearly all within the following 48 hours.

DMLSS appears to be one of the MHS's most successful systems and, because the MHS has been working well with users to iron out the few problems that remain, IDA has no further recommendations.

C. Theater Medical Information Program (TMIP)

1. Description

TMIP is the MHS's plan for addressing the needs of deployed medical units for information support. The TMIP mission is to provide an integrated suite of automated medical information system solutions to support the warfighter. This "system of systems" is designed to capture the medical record at all levels of care and to link care in the theater of conflict with the sustaining base.

TMIP will provide capability in four functional areas:

- Health care delivery—decision support tools, care plan documentation, medical surveillance, and management of blood/blood product inventories;
- Medical logistics—resupply, inventory and assemblage management, and product identification;
- Command and control—analysis of medical sustainability and supportability assessments of Class VIII assets (medical supplies and blood); and
- Control of patient movement (called “patient regulation”)—integrate patient movement and medical regulating capabilities from the TRAC²ES program.

Because it is to be used in theater, TMIP must comply with the general theater operating and communications environment. It must be compatible with the Global Command and Control System/Global Combat Support System computing environment. Because communication links may not always be available, it must be capable of caching database changes for future transmission. Furthermore, since it is deployed, the platform must be a relatively small portable computer.

The first 3 years of TMIP, which began in 1997, were spent in proof of concept. Because of the constrained theater computing environment, the office responsible for TMIP first thought of developing new patient encounter software, but abandoned that approach for one of integrating existing software. The latter approach is more consistent with the philosophy “to do in war as you do in peace.” As a consequence, TMIP software is being developed by integrating mostly existing medical information systems, modified as necessary, into a federation of systems to provide enhanced automated information management support that is intended to be both user-friendly and efficient. Project managers for the individual integrated component systems are responsible for developing software modules or enhancements if and when required. TMIP is responsible for software and systems integration. Each of the military Services is responsible for deploying the software, providing the infrastructure (communications hardware and computers), and sustaining the system.

TMIP development is based on an evolutionary acquisition strategy, with functionalities brought online in blocks. The approach to meeting the requirement consists of first providing the appropriate computing environment, and then using software modules that either already exist or are under development (with modification where needed) to provide the capabilities noted

above. The development of TMIP is planned in three blocks. Block 1 provides the computing environment and will use existing software: CHCS NT, CHCS (Theater) for medical care (versions of CHCS I and CHCS II respectively); TRAC²ES for patient regulation; the Medical Analysis Tool for medical planning; and existing military department logistics and command and control software. Blocks 2 and 3 will preserve the computing environment in Block 1 but will provide additional software capabilities and updates for the capabilities as they arise. Block 2 will provide additional clinical capabilities obtained from CHCS II, integrate medical logistics capabilities for all levels of care from DMLSS Release 3, and provide capabilities from the Defense Occupational and Environmental Health Readiness System. Plans for Block 3 are to introduce additional encounter capabilities such as dental and vision support, as well as improving theater linkages with the continental U.S. support base.

2. Capabilities

TMIP Block 1 is currently in alpha testing and Initial Operational Capability is scheduled for the fourth quarter of FY 2003. It will provide the following capabilities:

- Medical planning,
- Collaborative planning,
- Medical reporting for inpatients and outpatients,
- Medical logistics support,
- Blood management support,
- Interface with an electronic device that stores information about the person who carries it,
- Immunization tracking, and
- Clinical encounter data collection (to include symptoms and potential environmental and occupational exposure data) at point of care.

The contract for TMIP Block 2 is expected to be awarded in the fourth quarter of FY 2003. It will provide the following additional capabilities:

- Far-forward data collection and decision support,
- Interface with DoD approved information carrier,
- Medical logistics inventory management support,
- Environmental health data collection,
- Occupational health data collection,
- Preventive health data collection, and
- Patient movement support.

Block 3 will build on the capabilities in Blocks 1 and 2. Full Operational Capability will be achieved in Block 3.

A limited user test on a prototype of TMIP Block 1 was conducted at Fort Sam Houston in conjunction with a test of Army TMIP hardware. Further testing is underway at present. The DoD Director of OT&E noted that (1) TMIP will depend heavily on the successful operation of the systems that will provide its capabilities and (2) slippage in any of these systems will result in slippage of the program as a whole.⁸ During the limited prototype test, all of the features and capabilities that were available for testing worked, but these included only about half of the initial operating capability features.

3. Evaluation

Since TMIP is undergoing alpha testing, there are not yet any users available for interview. However, over a 4-day period in October 2002, the TMIP Program Office organized a System Qualification Test (SQT) to provide an initial evaluation of the functional capabilities of TMIP Block 1. A selected group of 14 medical Subject Matter Experts (SMEs), representing the four Services and the United States Joint Forces Command and spanning the major occupational specialties expected to use TMIP, participated in the SQT. The report of the SQT, which was conducted by PEC Solutions, Inc., an independent developmental test and evaluation contractor, concluded that "the SMEs unanimously agreed that TMIP is sufficiently mature, functionally, to move to the next level of testing ..." with the requirement that a few identified deficiencies be corrected. Because there are still no users to interview, we were unable to assess the extent to which the identified deficiencies have been addressed by the MHS.

4. Findings and Recommendations

The IDA team commends the MHS's decision to develop TMIP as a federation of mostly existing medical information systems. Furthermore, assigning to the program management offices responsible for the existing systems the task of adapting them to the special needs of TMIP is a most effective approach to achieving a successful product.

Because TMIP operates in a theater environment, there will be times when communications capabilities are unavailable. The theater variant of CHCS II has been designed to use a local cached image of the CPR, which is maintained in the CDR. Changes made in the field to the cached CPR are transmitted to the CDR,

⁸ U.S. Department of Defense, Director of Operational Test and Evaluation, "FY 2001 Annual Report of the Director, Operational Test and Evaluation," Unclassified Version, February 2002, pp. VI-57 to VI-58.

keeping the CPR up to date once communications are resumed. This feature, necessary for TMIP, is so desirable that it might be appropriate to consider replacing CHCS II with a similar variant also using the local cache scheme. Such an approach would provide CHCS II with a measure of protection against major communications failures in peacetime.

TMIP is currently undergoing alpha testing, which will continue into the second quarter of FY 2003. At this point, it is too early to judge how successful this effort will be.

D. Centralized Credentials Quality Assurance System (CCQAS)

1. Description

The MHS describes CCQAS as a web-enabled, centralized, tri-Service, repository of credentials, risk management information, and adverse actions data for active-duty, Reserve, and Guard clinician and clinical support personnel. This information is provided for both privileged and non-privileged providers who hold licenses or special certifications.

When fully implemented, CCQAS will consist of three modules—a credentials module, a risk management module, and an adverse actions module. However, at the time of our evaluation, no single version of CCQAS had implemented all three modules. CCQAS version 1.5 contains only credentials information and is deployed at 540 MTFs and Reserve/Guard centers. CCQAS version 2.0 implements risk management and is only deployed at Navy and Air Force headquarters levels.

The most recent deployed version of CCQAS is version 2.6.7. Like version 1.5, version 2.6.7 implements only the credentials module, although with considerable improvements over its predecessor. At the time of our evaluation, version 2.6.7 had 796 users at 366 activities and contained 44,356 active credentials records. Deployment consists of data conversion plus implementation and training. Implementation involves setting up user accounts and permissions.

The software for the other two modules is said to be complete but non-functional due to the lack of converted data. According to the MHS, the required data conversion routines have been completed and the other two modules are scheduled to be functional in June 2003.

2. Capabilities

The CCQAS credentials module includes provider demographics, primary education and residencies, licenses, specialties, additional training, continuing medical education, board certifications, medical malpractice insurance for

contract providers, National Practitioner Database findings, an MTF assignment history, and a photograph. This module is designed to allow medical and dental facilities and Reserve and Guard units to record information about the credentials of their providers, including the dates that this information was validated by the primary source. The credentials module also maintains basic information about a clinician's privileges, which must be granted individually by each facility's commanding officer. The system facilitates the process by which clinician credentials and privileges must be revalidated every 2 years or upon appointment to the medical staff.

The risk management module includes medical malpractice claims and cases barred by *Ferres vs. United States* (1950) that may be pending (these cases result from the inability to sue military personnel acting in the course of military service). The adverse actions module provides information to support due process for clinicians who are under investigation and may have actions taken against them regarding their ability to practice.

3. Evaluation

a. User Survey

To bolster its claim that users are generally satisfied with CCQAS, the MHS provided us with the results of a single-question, e-mail survey sent in October 2002 to all registered users of CCQAS 2.6.7. The question asked was: "How satisfied are you with CCQAS 2.6.7 helping you perform your job?" The possible responses were "extremely satisfied," "very satisfied," "satisfied," "less than satisfied," "very dissatisfied," or "don't know." Of over 600 registered users, only about a third responded. Although the results were largely favorable to CCQAS (over 80 percent of the responders reported they were satisfied or better), the combination of poor response rate and generality of the question asked severely limits the survey's usefulness for our evaluation.

b. User Interviews

We had an opportunity to interview only two users of the system—an experienced Navy user and a functional expert acting as a liaison to the CCQAS developers who was familiar with the system but not a regular user. Since neither user was from the Army (the Service with the most users) or the Air Force, we could gain only a limited perspective on the performance of the system.

Since we could not assess data validity or privacy protection, the focus of our assessment was on functionality. The Navy user asserted that CCQAS 2.6.7 represents a significant improvement over previous paper-based systems in its

ability to access and query a centralized data repository of DoD-credentialed health care providers, regardless of the military medical department to which the providers belong. We were told that, in some cases, updating of records is automatic and that there are built-in notifications of imminent license expirations for professionals with time-sensitive credentials. The paper system still serves as a backup, particularly in cases where the Services require signed originals. Any further elimination of data entry is likely dependent on additional interoperability between CCQAS and other MHS and Service-specific systems.

The Navy user reported that the 3-day training program provided was more than adequate to become self-sufficient on the system, particularly given prior exposure to database systems in general and to the prior credentialing system in particular. He further reported that the help desk was sufficiently responsive to inquiries. The MHS has a process to review open help-desk tickets every 2 weeks with the Services, the hosting DISA site, and the developer.

The Navy user reported that credentialing queries that used to take hours or even days could now be reliably performed in minutes, although the actual response time was a function of the Internet connection and the complexity of the attributes chosen. The MHS expressed its plans to further improve this situation by moving the report function to a separate server and to employ Oracle Discover or BusinessObjects as the on-line analytical processing tool for users. Standard reports for less sophisticated users would still be available.

During the brief interview, we learned of only a few shortcomings of CCQAS 2.6.7. One temporary problem stemmed from the lack of existing board certification data (except on paper records). The MHS made a data conversion decision to initialize all board certification dates to 1900 until correct dates could be entered from paper records. The Navy user indicated that much of his time is now devoted to this one-time process of entering correct dates for board certifications, but accepted this as a necessary part of moving to a more fully automated system.

Another limitation stems from the unwillingness of two of the Services to accept electronic Inter-facilities Credentials Transfer Briefs (ICTBs) when transferring credentials between facilities, necessitating the transfer of signed paper documents. The Navy has adopted a policy on electronic ICTBs that allows their use in certifying medical credentials. The Navy, therefore, can transfer certified credentials information electronically through CCQAS. The Army and Air Force have not yet adopted such a policy and require signed paper copies of credentials reports as well as the electronic ICTB. (The Services still maintain their own credentials and privileging processes in addition to CCQAS.) The reluctance of the Army and Air Force to rely on the electronic ICTB is an impediment to the full effectiveness of the system. The MHS claims that full

workflow processing supported by electronic signatures will be available in CCQAS version 3.0 (currently under development), but it is not clear whether this will overcome the reluctance of the Army and Air Force to accept purely electronic transfers.

The Navy user also pointed out that there are some limitations with the reporting capabilities of CCQAS that stem from the lack of standardization across the DoD. To comply with local formatting conventions, he often had to export CCQAS-generated files into Microsoft Word for further customization. He suggested that, until standard formats are adopted, the ability to save a customized report that implements local conventions might be a useful additional capability.

Another issue limiting the effectiveness of CCQAS is its ability to interface with other information systems (we have not been able to evaluate the planned system-within-systems design). The Resources Information Technology Program Office informed us that CCQAS 2.6.8 will have an interface to the VA's VetPro application for an operational test at three DoD/VA Resource Sharing sites. They also told us that CCQAS 2.7 will integrate CCQAS with DMHRsI, CHCS I, and DEERS to support the Primary Care Manager by Name Program and the TRICARE Next Generation of Contracts. The MHS plans to interface CCQAS 3.0 with all of the preceding systems, as well as with CHCS II and additional information systems.

4. Findings and Recommendations

The IDA team believes that CCQAS 2.6.7 is clearly an improvement over CCQAS 1.5. When the second and third modules are implemented, it will fully supersede CCQAS 2.0. The IDA team recommends the following:

- The MHS should proceed with its plans to work with the Services to deploy the risk management and adverse actions modules. This will involve converting legacy risk management and adverse actions data and ensuring data validity, integrity, and security.
- The MHS should standardize credentials and privileges processes and implement these processes in CCQAS. This would facilitate the sharing of clinical resources among the Services as well as the execution of readiness requirements.
- In addition to supporting typical users with standard and ad hoc reports built into the application, the MHS should proceed with plans to move the report function to a separate server in CCQAS 3.0, and provide additional tools to support users who need to perform sophisticated queries on a large data set.

- The MHS should proceed with plans to develop interfaces between CCQAS and other MHS and Service systems. The MHS should clarify data ownership and eventually identify a single entry point for each data element.
- The MHS should continue to work with its developers to incorporate electronic signatures into CCQAS 3.0. Failure of all military medical departments to accept electronic signatures obviates a substantial benefit of CCQAS.

E. Defense Medical Human Resources System–internet (DMHRSi)

1. Description

DMHRSi is a tri-Service management support system that is intended to standardize and optimize the utilization of human resource assets across the MHS. The military medical community will use DMHRSi to help it standardize the management and reporting of human resources across all three Services. The medical human resources managed by DMHRSi include military, civilian, volunteer, contractor, and eventually even borrowed human assets. The information within DMHRSi will be able to be rolled up by department, activity, region, or by major command, Service, or OSD level.

DMHRSi delivers critical functionality to the MHS since a large fraction of the \$29 billion FY 2003 Defense Health Program is dedicated to human resources, yet no centralized tool to manage these assets has previously been available. The legacy situation involves multiple systems, each with different subsets of medical personnel data, that are not interoperable and that run on various hardware assets. The acquisition strategy for the development of DMHRSi relies heavily on COTS products. DMHRSi will eventually implement over one hundred standardized human resource functions. Because it is web-based, DMHRSi will allow users to update their own data, submit labor reports, and track enrollment in local courses.

2. Capabilities

DMHRSi planned capabilities include tri-Service support for the following MHS functional areas:

- Manpower
- Personnel management
 - Labor cost assignment
 - Work center assignment
 - Medical expense assignment/cost allocation

- Personnel readiness
 - Deployment
 - Assignment
- Education and training
 - Course management
 - Training application and completion.

Worldwide deployment for eventual use by 150,000 users is scheduled to begin in April 2003. By September 2003, a total of 14 hospitals and 106 clinics are scheduled to have DMHRSi installed. During FY 2004, an additional 26 hospitals and 194 clinics are scheduled for installation, with 35 hospitals and 225 clinics being scheduled for installation during FY 2005. In addition, Service medical department headquarters, school commands, and all other DHP activities will be included in the geographic region-based deployment. Full deployment requires a positive Milestone C decision in March 2003.

3. Evaluation

Since DMHRSi had not yet been fielded at the time of our evaluation, there were no users to interview. However, there are already limited deployment tests underway at three sites where actual Service data are being entered and manipulated. The MHS claims that user evaluations and continual feedback at the prototype sites are being used to refine and improve DMHRSi processes. Until the system has been deployed, however, we will not be able to independently evaluate its capability to meet stated goals and objectives.

4. Findings and Recommendations

DMHRSi uses the Oracle 9i database and packages from the Oracle 11i e-Business Suite to implement human resources functionality. The participating packages from this suite include Oracle Human Resource Management System, Oracle Training Administration, Oracle Project Administration, Oracle Self Service, and Oracle Discoverer. This approach is in contrast to alternative approaches that might build upon specific human resources packages, for example, Oracle-HR or PeopleSoft. There are advantages (e.g., lower cost and greater flexibility) and disadvantages (e.g., development and ownership of a larger system) associated with the chosen approach. We note that the developers of the Defense Integrated Military Human Resources System (DIMHRS), the tri-Service personnel system currently in development and with which DMHRSi will eventually need to interoperate, have chosen to build the military-wide personnel replacement system using PeopleSoft over an Oracle database.

The MHS decision to use a more generic tool set is probably consistent with the smaller size of the project (relative to DIMHRS). The fact that two different approaches are being used for these parallel and related developments does not necessarily foretell problems as long as there is frequent and useful communication between the DIMHRS and DMHRSi offices. We were encouraged to hear that this communication has already begun. Potential future issues that will need to be addressed include the reconciliation of data definitions and ownership between the systems and the migration of DMHRSi data into DIMHRS, leading to the eventual decommissioning of DMHRSi (a step that might be taken 8 to 10 years from now).

Given the MHS mission, the requirement for DMHRSi is clear and the ability to decommission numerous legacy systems is an added benefit. However, our experience with business process reengineering and the unification of military department personnel procedures and standards has been mixed at best and suggests that there could be growing pains when the replacement system is deployed. In these situations, components or Services often discover that a legacy process cannot be superseded, requiring one or more legacy systems to continue operating. The MHS claims that it mitigates these risks by accepting direction and support from the tri-Service Human Resources Steering Committee (HRSC). The HRSC, whose members are appointed directly by the Service Deputy Surgeons General, is responsible for the change management required in association with the DMHRSi deployment. This oversight should, in principle, provide the guidance to ensure that all required medical personnel, readiness, and training processes across the military are supported by DMHRSi, while avoiding any temptation to simply develop replicas of the existing legacy systems.

F. MHS Mart (M2)

1. Description

The MHS Mart (M2), formerly known as the All-Region Server (ARS) Bridge, is a database query tool designed to support decision makers and resource managers throughout the MHS. Part of the Executive Information/Decision Support (EI/DS) suite of tools, M2 offers the ability to obtain summary and detailed views of population, enrollment, clinical, workload, and financial data from direct and purchased health care delivery systems across all Health Service Regions (including overseas). The M2 servers (a repository, a staging server, and a database server) are located at the Defense Enterprise Computing Center in Denver, Colorado. The repository server, a DEC

2100, is used for login and authentication of users. The staging and database servers are used for all other processes and are IBM RS-6000 nodes. The M2 uses Informix, running on IBM AIX (on the RS-6000 nodes) and DEC Unix on the DEC 2100. M2 was first deployed in early FY 2001 and is currently in Release 2.0.1.

The EI/DS Program Office touts M2 as a tool that allows the user to create custom reports quickly and easily without needing to know SQL, RDBMS commands, or the structure of the underlying database. It is built on the BusinessObjects 2000 business intelligence platform, a state-of-the-art commercial application that offers integrated query, reporting, and analysis solutions for the enterprise. Platform extensibility enables integration into an organization's existing environment. The platform is adapted to the unique aspects of the enterprise through the construction of "universes," which are made up of classes and objects that map to the underlying enterprise data sources. In the case of the MHS, the underlying data are housed in the MHS Data Repository (MDR) and M2 is the universe that links users to the MDR through a user-friendly interface.

Prior to M2 and the MDR, the primary ad hoc query tool available to users was the Corporate Executive Information System (CEIS), which consisted of regional data-marts and warehouses. Each warehouse and corresponding data mart contained direct and purchased care data for a single region. This allowed Lead Agents to access data for their region, but to obtain nationwide or worldwide data, a user would have had to run queries from each of the regional data marts and integrate the results. CEIS was comprised of McKesson-HBOC COTS products called Quantum, Trendpath, and Trendstar. Quantum and Trendpath were standard reporting tools and Trendstar was an ad hoc reporting tool. Users could also access direct-care data through CHCS and BusinessObjects for Ambulatory Data System reports. Users could (and still can) obtain purchased care summary reports through the Care Detail Information System (CDIS), CHAMPUS/TRICARE Medical Information System (CMIS), and the CHAMPUS/TRICARE Utilization Reporting and Evaluation System (CURES). Selected users had access to SAS data sets as well.

2. Capabilities

Because of the sheer volume of data housed in the MDR, the EI/DS Program Office must filter the data elements accessible through M2. Given constraints on the amount of data it can process in a reasonable amount of time, the system has the capacity to hold 4 to 5 years of current and historical data. The initial requirements and capabilities needed by users of M2 were developed by the M2 Functional Proponency Group (FPG), headed by the TMA Director for Health

Program Analysis and Evaluation, and consisting of representatives from each of the Services. The FPG continues to serve as the main conduit for suggested capability enhancements, both through Service representatives and user inputs forwarded by the MHS Help Desk. The EI/DS Program Office indicates that requests for enhancements have decreased relative to initial development and that these enhancements are incorporated into scheduled maintenance releases three times per year.

3. Evaluation

Our evaluation of M2 is based on hands-on usage of the system as well as an interview with an Operations Research analyst from the Navy's Bureau of Medicine and Surgery. Because our experiences with the system were so similar to those of the Navy analyst and her colleagues, we have some degree of confidence that our impressions are representative of the user community at large.

Although we are impressed with the capabilities of M2, users unfamiliar with BusinessObjects (we suspect most users fall into this category) are likely to encounter a fairly steep learning curve. In fact, over half the problems reported to the MHS Help Desk during the first 10 months of FY 2002 (the latest data available) were software-related. The learning begins upon installation, which requires many interventions by the user and, if the user's computer is behind a firewall, the assistance of a network administrator. The online tutorial provides a useful introduction to BusinessObjects in the context of the M2 data mart, but some users are likely to encounter the need for more complex queries that are not covered by the tutorial. The M2 Help Menu provides a complete BusinessObjects User's Guide, but it is over 650 pages long and difficult to navigate. This leaves the MHS Help Desk as the most likely recourse for assistance with software functionality.

The areas where we feel M2 can be improved are (1) object naming and coding and (2) documentation. The M2 object classes contain several similarly-named objects that are inconsistently coded. For example, the Enrollment Site object is variously coded as null or 'none' for nonenrolled beneficiaries. Similar inconsistencies occur for the Alternate Care Value (which indicates a beneficiary's enrollment status), Beneficiary Category, and possibly other objects as well.

Documentation of the data classes and objects found in M2 is provided in an Excel spreadsheet, which can be downloaded from the EI/DS web portal. The documentation is updated monthly, in consonance with the monthly updates of the M2 data mart. However, the user needs a deeper familiarity with the systems

produce and the data edits that are performed on the MDR source data to understand the reports produced by M2. For example, a direct query of the MDR database will yield a larger number of inpatient dispositions recorded on Standard Inpatient Data Records (SIDRs) than will M2. This can occur because M2 filters out SIDRs that have not yet been signed by the attending physician. Similarly, a query of the PDTS class in M2 will produce a different count of the number of direct, retail, and National Mail Order Pharmacy prescriptions filled than will separate queries of the classes representing those points of service. The ostensible anomalies can occur because M2 intentionally filters MDR data. The criteria the EI/DS Program Office uses to filter the data are not clear, however. Currently, the user has no simple way of discerning why seemingly different data may yield different results.

This comment was repeated by the Navy user, who indicated that a large portion of the steep learning curve she experienced involved discovering which of the several sets of similarly-named data should be used for which purpose. She considered M2 to be a power system intended for sophisticated users and thought that more pre-defined queries would help inexperienced users extract data more reliably.

Findings and Recommendations

The M2 data mart represents a significant enhancement in the ability of users to access and query the MHS's centralized data repository in a timely manner. Because issues of data quality, uniqueness, and privacy protection are addressed by the MDR, the focus of M2 is on functionality. Queries that used to take hours, or even days to accomplish under CEIS can now be performed in minutes, depending on the number of users simultaneously logged on to the system. There are currently about 500 users of the system, with plans to expand the number to about 750. During peak periods, the system runs noticeably slower, so there is a risk that a substantial increase in the number of users will significantly degrade performance unless there is an accompanying increase in server capacity and speed.

There are a number of relatively simple steps the MHS can take to simplify the system for less experienced users and to reduce user confusion with the interpretation of complex measures and dimensions. First, the IDA team recommends that the MHS consider providing a collection of pre-defined queries to yield commonly requested data from M2. Users can then run these queries as is or modify them as necessary to address a particular request. This should ease the learning curve somewhat for less experienced users. Second, the MHS should attempt to standardize variable definitions across object classes to the extent

possible. Users are less likely to make mistakes if same-named variables have common definitions and values across object classes. Third, because users are more likely to get the results they desire if they have a better understanding of the data that underlie their queries, the MHS should consider providing detailed online documentation of object definitions and derivations.

The IDA team also recommends that the MHS consider developing a means for users to run batch queries (i.e., a series of saved queries to be run consecutively). That would save users time by eliminating the need for them to be at their computers to run each query. (For example, they could all be run overnight.) Finally, the IDA team recommends that the MHS develop object measures that indicate the number of unique users for each class of health care services. Currently, the query must generate a list of all unique users (e.g., by Social Security Number) and have BusinessObjects count them. This often results in unwieldy report output and pushes against the M2 limit of 500,000 rows of data.

G. Third Party Outpatient Collection System (TPOCS)

1. Description

Some MHS beneficiaries who receive care in MTFs have private health insurance coverage in addition to TRICARE. In cases where beneficiaries report having such coverage, the MTF that provided the care becomes the second payer and can seek reimbursement from the insurance company.

Before October 1, 2002, third-party outpatient billing was done at individual MTFs by a DoD-unique system that produced an all-inclusive, lump sum bill. The amount billed was based on a DoD-wide average cost to provide care in a work center (e.g., outpatient internal medicine), using data from the Medical Expense and Performance Reporting System (MEPRS). Only about 40 percent of the sites transferred data from CHCS I to TPOCS electronically. The other 60 percent chose to transfer the data manually, even though the electronic capability had been available for some time.

This billing method presented disadvantages for DoD. The private insurance industry uses a completely different, itemized billing system. Claims processors often rejected a bill out of hand, because it did not provide sufficient detail. Moreover, the system did not have many on-line reference tools for coding; it lacked the automated coding and billing compliance capability standard used by the private sector.

According to a recent GAO report⁹ based on visits to three MTFs, these MTFs did not identify all patients with other health insurance and frequently did not bill the insurers when they knew about other insurance. The report cited as corroboration an Air Force Audit Agency report¹⁰ that found insurance information was not being obtained and recorded for over 70 percent of the non-active-duty inpatient population at 14 MTFs.

The GAO recommended, and DoD concurred, that MTFs should emphasize collecting patient insurance coverage in its automated information systems, billing third-party carriers promptly, and collecting third-party reimbursements to the maximum allowed as required by DoD policy. The DoD also recommended that MTF leadership be held accountable for third-party collections.

2. Capabilities

Since October 2002, DoD has mandated outpatient billing through TPOCS according to the commercial format. TPOCS supports itemized outpatient billing and is deployed at 125 locations worldwide—primarily at military hospitals but also at some outpatient clinics. It is a client-server IT solution, using electronic data interchange.

Billing for inpatient care is handled by inpatient billing modules of CHCS. These modules generate DoD-unique, cost-based, per diem bills. DoD plans to eventually institute itemized billing for inpatient care as well.

Once a provider enters data related to an outpatient visit into CHCS, the data items extracted and sent to TPOCS include:

- Whether or not the patient has other health insurance,
- Patient encounter data,
- The Standard Insurance Table,
- Professional codes, and
- Laboratory, radiology, and pharmacy services supplied.

TPOCS takes these data items and produces itemized bills. These bills are either sent to a clearinghouse using SSL 128-bit encryption or mailed to the third-party insurer.

The system planned for future use by DoD is the Patient Accounting System (PAS). It will be a client-server, COTS-based solution that will provide modern

⁹ U. S. General Accounting Office, "Military Treatment Facilities: Internal Control Activities Need Improvement," GAO-03-168, October 2002.

¹⁰ Air Force Audit Agency, "Follow-up, Third Party Collection Program," Audit Report 00051011 (Washington, D.C.: April 26, 2001).

coding, compliance, and billing processes for both inpatient and outpatient services. PAS will replace pertinent capabilities in the CHCS legacy system, and will completely replace TPOCS. It will contain coding and compliance applications along with a data repository and will be interfaced with both CHCS I and CHCS II. There will also be comprehensive on-line coding reference applications. The MHS expects that PAS will foster improvements in data quality. However, developers recognize that training and motivating clinicians will take time.

A major breakthrough will be revenue optimization tools. Again, the commercial sector has well-established revenue optimization policies, and, with PAS, DoD will be in step with the rest of the industry. Ultimately, DoD will go to a Chargemaster-based billing system, a system used widely in the health care industry.

The acquisition of PAS COTS applications was scheduled for September 2002. The system integrator, Park City Solutions, was selected at the same time. In the proof of concept (prototyping) phase, PAS will be deployed at two sites, one with CHCS I and the other with CHCS II, to test the outpatient coding and compliance applications in late FY 2003.

During FY 2004, the inpatient coding and compliance applications will be upgraded, and the Chargemaster billing system to follow will include coding applications for both inpatient and outpatient care. The total solution is planned for full deployment by FY 2007.

3. Evaluation

The transition to itemized billing using TPOCS 3.0 is still underway. Based on our user interviews, the transition has been difficult for some, compared to past software conversions. According to one user of the new system, no bills had been sent from her MTF since October 1 because, according to MHS policy, they could not send bills in the old format and the system to generate itemized bills did not yet work. One user reported that patient date of birth, which is required by many insurers, is not included in the automated transfers from CHCS through the MDR to TPOCS. This group of 10 TPOCS users was unable to generate an acceptable itemized bill in the 6 weeks they had been using the system. We understand that Navy and Air Force users have reported similar problems sending out their initial batch of itemized bills.

According to the MHS, these transition difficulties are confined to sites that had not previously used electronic transmission of data from CHCS to TPOCS. Once this electronic transmission is set up correctly (which appears to require several complex steps), sites are able to produce itemized bills using TPOCS 3.0.

It is important to note that the transition to itemized billing involves not just new software, but new business practices. For example, the Air Force has mandated an additional security step that may cause further delays in the billing process.

Since 1998, the MHS has collected roughly \$110 million per year from third parties. The amount has remained steady rather than showing an upward or downward trend. Billings are based on beneficiary reporting of other health insurance. For outpatient claims, DoD collected \$70 million during FY 2001.

Evidence presented by DoD suggests that collection rates (the percentage of the total billed that is collected) will increase under TPOCS. DoD officials have observed an improvement in collection rates, which are currently between 40 and 50 percent.

Manpower efficiencies may also be possible. It could be more efficient, for example, for a central group of contractors to do coding than to have government employees code at each MTF. There are a number of reasons for this. There are contractors who are trained in coding to maximize the size of billings. The government employees tend to have lower wage scales, and there is a great deal of turnover.

The MTF-localized system makes it difficult to attain these efficiencies, unless individual MTF commanders change their business processes. There is some evidence, though, that this is happening. The Services are using professional coders familiar with the new system, and the Air Force does some coding at the regional level.

While the automated system should speed coding and billing, the itemized system requires more bills—separate bills for professional services, radiology, and drugs, for example. In addition, the transition costs when systems are changed could be substantial. The MHS expects that Chargemaster-based billing will result in increased revenue collection, potentially up to 60-90 percent of the amount billed based on industry standards. Additional revenue may be realized through improving business processes centered on collection of third-party insurance information.

4. Findings and Recommendations

The GAO recommended, and DoD concurred, that MTFs should emphasize collecting patient insurance coverage in its automated information systems, billing third-party carriers promptly, and collecting third-party reimbursements to the maximum allowed as required by DoD policy. DoD also recommended that MTF leadership be held accountable for third-party collections. These

business practice changes seem appropriate to achieve the efficiencies possible with TPOCS.

The MHS needs to focus more attention on transition difficulties, particularly at sites that have not previously transferred data electronically to TPOCS. IDA recommends closer coordination between the system designers and business practice specialists in helping users.

The IDA team also recommends that the MHS study the potential for centralized billing, perhaps by contract personnel, to increase revenue or reduce billing costs. We understand that the Army and the Air Force are trying contractor operations at some locations. Centralized billing, however, may offer substantial economies of scale.

IV. Interagency Data Exchange

A. Introduction

The congressional language asked DoD to provide “an assessment of the ability of the Department of Defense to exchange clinical and management information with other federal and state agencies and private sector health services providers in a timely and reliable manner.” This section contains material to facilitate that assessment.

MHS patients tend to be highly mobile, and their medical records may be housed in multiple locations inside and outside the United States. According to the GAO, benefits from an enhanced ability to exchange data include “improved patient care; providing data for population-based research and medical surveillance; advancing industry-wide medical information standards; and generating administrative and clinical efficiencies, including cost savings.”¹¹

Medical surveillance needs have gained more attention recently, both because of unexplained illnesses of Gulf War veterans and because of concerns about terrorist attacks.

B. Status of Interagency Data Exchange

1. Initial GCPR Effort

The Government Computer-Based Patient Record (GCPR) program was initiated in 1998 by the DoD, the VA, and the Indian Health Service. Initial efforts suffered from cost and schedule growth and prompted a restructuring of the program around the end of 2000. Focused efforts by the CIOs of the MHS and the Veterans Health Administration (VHA) resulted in an interim goal to allow the VHA to view DoD data by the Fall of 2001.¹²

¹¹ U.S. General Accounting Office, “Computer-Based Patient Records: Better Planning and Oversight by VA, DoD, and IHS Would Enhance Data Sharing,” GAO-01-459, April 2001.

¹² *Ibid.*

2. Data Exchange with the VA

Thus far, data exchange with the VA has been one way, from DoD to VA. Only 1.9 million separated and retired Service members have CHCS records,¹³ but the fact that some members have multiple records means that extracts from 3.9 million records need to be transferred to the VA. There are 1.14 million unique patients with *electronic* medical data. There are 0.4 million patients registered in the VA system who have clinical data. The DoD does not provide the entire medical record, only the data fields requested by the VA and approved by DoD. The procedure is HIPAA-compliant and has been approved by the DoD/VA Executive Council. Data quality and data integrity validation/verification have been completed.

DoD medical records to be shared are encrypted and sent to the MDR for processing. Then they are sent securely and electronically to the Federal Health Information Exchange (FHIE) Data Repository.

Data shared initially include laboratory and radiology results, outpatient pharmacy, admission, discharge, and transfer messages, and patient demographics.

The VA accesses both its own and DoD health care data through its Computerized Patient Record System (CPRS). The remote view capability of the CPRS allows VA users to view health data simultaneously across multiple facilities. As of July 2002, the interagency software was installed on 128 VA computer systems. Training and implementation for CPRS users at 206 locations is ongoing.

This initial step has limitations. Data are not visible immediately but may take as long as 48 hours to retrieve. MTFs cannot yet access data from another MTF. Neither the current version of the system nor the next planned version provides for a longitudinal record as long as DoD is using CHCS I. CHCS I does not have data on the initial health status of entering Service members, National Guard and Reserve personnel not on active duty, or non-MTF care for Service members. As discussed in the next subsection, data standards are still being developed. Nevertheless, sharing data with the VHA should enhance continuity of care in the VA system.

Phase II, *HealthPeople* (federal) is a joint VA and DoD effort to improve sharing of health data and information; develop standards for architecture, data, communications, security, technology, and software; pursue joint procurements or development of software; look for opportunities for sharing existing systems and technology; and explore convergence of VA and DoD health information

¹³ The Defense Manpower Data Center provides notifications of personnel separations.

applications consistent with mission requirements. The schedule for two-way data flow between DoD and VA envisions implementation by 2005. This strategy will result in health records that are interoperable with CHCS II and VA's HealtheVet strategy for VistA. Once DoD and VA systems become more standardized, additional federal partners and non-federal public and private health organizations may be included.

3. Interagency Data Standards: The HIISC

DoD participates in the Health Information Interoperability Standards Council (HIISC), an interagency group led by the Centers for Medicare and Medicaid Services (CMS) in the Department of Health and Human Services. The council was planned in December 2001 in response to the Consolidated Health Informatics eGOV initiative. The HIISC is working to define data standards; this effort will probably lead to mandated standards that government contractors will have to meet.

While there are no current exchanges of data between the MHS and state or private agencies, the MHS has provided information on its use of Universal Product Numbers (UPNs) for pharmaceuticals. This system allows DoD to identify the location and amounts of any particular drug worldwide. At least one private insurer has expressed interest in the system. If adopted as a standard, the UPN would speed the process of identifying drugs available to quell a disease outbreak. For example, such a standard would have been useful in identifying supplies of ciprofloxacin during the anthrax letter crisis.

C. Plans

According to the MHS, the next steps for FHIE involve the addition of the following data elements:

- Discharge summaries for inpatient stays, including diagnosis and procedures,
- Allergy information,
- Outpatient pharmacy data,
- Admission, disposition, and transfer information, and
- Consultation results.

D. Evaluation

In this evaluation, we relied solely on documents provided by DoD and on GAO reports. We have not been able to independently observe the interaction of DoD and VA systems.

It appears that initial programs to institute interagency data exchange suffered from unrealistic expectations. Efforts to restructure the longer-term effort are proceeding. Both DoD and the VA have stepped up their oversight of the GCPR project. Both agencies envision GCPR as a bridge across agency data systems rather than as a stand-alone longitudinal medical record.

DoD and the VA agree that there should be a lead entity, a comprehensive and coordinated plan, and a continuous reassessment of long-term goals and the methods for reaching them. The fact that both DoD and the VA are in the process of revamping their patient record systems may increase transition difficulties, but also creates the opportunity for developing interoperable systems.

The establishment of the HIISC is a key element of data exchange. It is unclear whether the ability of agencies other than DoD and the VA to exchange relevant information in a timely fashion has improved. The private sector also faces difficulties with data exchange.

The IDA team recommends that the MHS participate actively in the development of plans for communication with other federal, state, and private agencies. Such communication might include summarized information instead of or in addition to electronic data exchange. Development of such plans seems particularly important in the light of heightened awareness of homeland security issues, including the possibility of a biological attack on military personnel or civilians in the U.S.

V. Summary and Recommendations

A. Summary

We based our evaluation on documents provided by the MHS, recent evaluations by organizations such as the Gartner Group and the General Accounting Office, discussions with MHS staff and, for the systems that have been deployed, interviews with users made available to us by the MHS. Due to the short time available for the evaluation, our conclusions are more tentative than we would have liked.

The MHS IM/IT program has made great progress in moving towards best practices over the past 2 or 3 years. The progress is reflected in the investment portfolio and enterprise architecture processes as well as in the increased success of the systems under development.

B. Recommendations

Listed below are recommendations for the portfolio development and enterprise architecture of the MHS IM/IT program, as well as observations and recommendations on specific systems. Some of the recommendations have less to do with the individual systems themselves than with the changes in business practices necessary to make full use of their potential.

1. Portfolio Development and Enterprise Architecture

The IDA team recommends that the MHS:

- re-examine the set of criteria used to evaluate individual packages to ensure that the rankings are correct;
- rank the packages in the material presented by the IM Division to the FIWG in terms of their value/risk evaluation per dollar rather than the absolute valuation scores; and
- increase the interaction between the PEO and the IM Division in developing cost estimates; and
- continue to develop and evolve the MHS EA and encourage mechanisms to use the EA at an early stage in portfolio investment decisions. Information on the mapping of new capabilities to the

common computing platform documented in the "to-be" system architecture should be provided to the FIWG.

2. Individual Systems

a. CHCS II

The IDA study team recommends that the MHS consider how it might capture data that exist in its own or others' paper patient records to see if such an effort is worthwhile in terms of improving the value of the computerized patient record in CHCS II.

The theater variant of CHCS II has been designed to use a local cached image of the computerized patient record. This feature, necessary for TMIP, is so desirable that it might be appropriate to consider replacing CHCS II with a similar variant also using the local cache scheme. Such an approach would provide CHCS II with a measure of protection against major communications failures in peacetime.

b. DMLSS

DMLSS appears to be one of the MHS's most successful systems and, because the MHS has been working well with users to iron out the few problems that remain, IDA has no further recommendations.

c. TMIP

TMIP is currently undergoing alpha testing, which will continue into the second quarter of FY 2003. At this point, it is too early to judge how successful this effort will be.

d. CCQAS

While the users of CCQAS are generally satisfied with it, the IDA team noted that the system has some problems, and that some users are having trouble getting the full value out of the system. The IDA team recommends that the MHS address the following issues:

- Expedite the migration of board certification data and any other non-computerized data from paper records to the computer system to minimize reliance on legacy documents.
- CCQAS can be improved in its ability to generate customized reports and to provide more templates for report generation within the system.

- Failure of all military medical departments to accept electronic signatures obviates a substantial benefit of CCQAS and should be addressed by the MHS.

e. DMHRSi

Since DMHRSi had not yet been fielded at the time of our evaluation, we were unable to independently evaluate its capability to meet stated goals and objectives.

f. M2

The IDA team recommends that the MHS consider the following steps to simplify M2 for less experienced users and to reduce user confusion with the interpretation of complex measures and dimensions:

- provide a series of pre-defined queries to yield commonly requested data from M2,
- standardize variable definitions across object classes,
- provide detailed online documentation of object definitions and derivations,
- develop a means for users to run batch queries, and
- develop object measures that indicate the number of unique users for each class of health care services.

g. TPOCS

The GAO recommended, and DoD concurred, that MTFs should emphasize collecting patient insurance coverage in its automated information systems, billing third-party carriers promptly, and collecting third-party reimbursements to the maximum allowed as required by DoD policy. DoD also recommended that MTF leadership be held accountable for third-party collections. These business practice changes seem appropriate to achieve the possibilities offered by TPOCS.

The IDA team recommends that the MHS consider centralized billing, perhaps by contract personnel, as a means of increasing revenue as well. We understand that the Army and the Air Force are trying contractor operations at some locations. Centralized billing, however, may offer substantial economies of scale.

The MHS needs to focus more attention on transition difficulties, particularly at sites that have not previously transferred data electronically to TPOCS. IDA recommends closer coordination between the system designers and business practice specialists in helping users.

3. Data Exchange with Other Departments

Although DoD and VA appear to be ahead of most federal agencies with respect to data exchange, the IDA team recommends that the MHS continue to work through the Health Information Interoperability Standards Council to improve data transfer with other departments.

The IDA team also recommends that the MHS participate actively in the development of plans for communication with other federal, state, and private agencies. Development of such plans seems particularly important in the light of heightened awareness of homeland security issues, including the possibility of a biological attack on military personnel or civilians in the U.S.

Abbreviations

ARS	All-Region Server
ASD	Assistant Secretary of Defense
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CCQAS	Centralized Credentials Quality Assurance System
CDIS	Care Detail Information System
CDR	Central Data Repository
CEIS	Corporate Executive Information System
CHCS	Composite Health Care System
CIO	Chief Information Officer
CMIS	CHAMPUS/TRICARE Medical Information System
CMS	Centers for Medicare and Medicaid Services
COTS	Commercial off-the-Shelf
CPR	Computerized Patient Record
CPRS	Computerized Patient Record System
CURES	CHAMPUS/TRICARE Utilization Reporting and Evaluation System
DEERS	Defense Enrollment Eligibility Reporting System
DHP	Defense Health Program
DIMHRS	Defense Integrated Military Human Resources System
DISA	Defense Information Systems Agency
DLA	Defense Logistics Agency
DMHRSi	Defense Medical Human Resources System–internet
DMLSS	Defense Medical Logistics Standard Support
DoD	Department of Defense
DOORS	Dynamic Object-Oriented Requirements System
EA	Enterprise Architecture
EBPS	Electronic Business, Policy, and Standards
EI/DS	Executive Information/Decision Support
EUD	End-User Device
FHIE	Federal Health Information Exchange
FIWG	Functional Integration Work Group
FPG	Functional Proponency Group
GAO	General Accounting Office

GCPR	Government Computer-Based Patient Record
HA	Health Affairs
HCSR	Health Care Service Record
HIISC	Health Information Interoperability Standards Council
HRSC	Human Resources Steering Committee
ICTB	Inter-Facilities Credentials Transfer Brief
IDA	Institute for Defense Analyses
IER	Information Exchange Requirement
IM	Information Management
IMT&R	Information Management, Technology, and Reengineering
IT	Information Technology
M2	MHS Mart
MDR	MHS Data Repository
MEPRS	Medical Expense and Performance Reporting System
MHS	Military Health System
MTF	Medical Treatment Facility
OASD	Office of the Assistant Secretary of Defense
OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation
OV	Operational View
PAS	Patient Accounting System
PDTS	Pharmacy Data Transaction Service
PEO	Program Executive Officer
POM	Program Objectives Memorandum
ROI	Return on Investment
SIDR	Standard Inpatient Data Record
SME	Subject Matter Expert
SQT	System Qualification Test
SV	Systems View
TFL	TRICARE for Life
TMA	TRICARE Management Activity
TMIP	Theater Medical Information Program
TPOCS	Third Party Outpatient Collection System
TRAC ² ES	Transportation Command Regulating and Command and Control Evacuation System
TV	Technical View
UPN	Universal Product Number
VA	Department of Veterans Affairs
VHA	Veterans Health Administration